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PROGRESS REPORT NO. 1

SPO 27203

GEMS PROGRAM

REPORT PERIOD: 10 JANUARY 66 to 18 FEBRUARY 66

ABSTRACT

This letter report describes progress being made on the continuance of a Gems Development Program. This first report is concerned with the organization of the program, a planned expansion of the existing Gems' Facility, and progress being made on two of the specific subtasks.

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1.0 PROGRAM ORGANIZATION

The schedule of activity set forth in the proposal and reproduced herein (see attachment) is being followed with the exception of the psychophysical portion of the Gems Study. The problem of rescheduling this activity will be discussed separately.

2.0 FACILITY AND STAFF

In order to ensure the availability of the personnel and photographic facility that had been engaged in the previous Gems program, it was necessary to undertake other Gems' contracts while awaiting authorization to proceed on the present program. While this was successfully done, it has resulted in an overload which will persist for the first three months of this 16½ month program. Two steps are being taken to resolve this overload. [redacted] STAT is preparing additional photographic facilities for the Gems' activities STAT and new personnel are being acquired. The expansion of the facility will be completed by 4 April 66.

3.0 SCHEDULE PROBLEM - PSYCHOPHYSICAL STUDY

Two factors have delayed the start of work on psychophysical testing. The first of these is the present overload of the photographic facility which is required in the preparation of the stimulus material (Psychophysical Gems Matrix). The second problem is one of contractor briefing. Here, it has been agreed that the contractor should have the benefit of a customer briefing and further access to customer facility in order to execute a psychophysical study of maximum value. As of this writing, one of the contractor's personnel, [redacted] STAT is scheduled to be briefed on 1 March 66. Subsequent to that briefing, the psychophysical tests will be reconsidered and rescheduled.

4.0 PROGRESS BY SUBTASK

In each monthly letter report a statement of progress will be given on each task on which work has been performed. These statements will in general be summary in nature. At such times as it is desirable to include greater detail, this material will be provided in appendicies to the report.

4.1 GEMS STUDY

4.1.1 REFINEMENT OF GEMS MAKING EQUIPMENT

The Gems making equipment that was prepared on the previous contract has two deficiencies associated with the illumination of the spread function mask. The intensity of the illumination in the plane of the mask is too low and of insufficient uniformity. The low intensity results in unreasonably long exposure times and the nonuniformity of illumination can cause errors in the modulation transfer function of the Gems produced by this equipment.

As a means of correcting these deficiencies, photometric measurements are being obtained on the illumination characteristics of alternate source configurations. High intensity incandescent sources of the iodide and bromide type are being evaluated in conjunction with multiple diffusers

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and reflectors. The best of these combinations will be selected as a replacement for the single diffusser and tungsten lamp now being employed. High intensity arc lamps are not being considered at this time because of the extensive modification that would be required to incorporate them into the Gems making equipment.

4.1.2 LIMITATIONS IN CONTROL OF MODULATION TRANSFER FUNCTION

The Gems making technique that has been employed to date takes into account the rectilinear propagation of the spread function mask and the modulation function of the master transparency. However, in the prediction of the resultant Gems characteristics, no allowance has been made for the diffraction effects of the transparency and it is recognized that this factor must be evaluated in establishing the upper limit of the technique.

The first step in evaluating the effects of diffraction (Fresnel or near-field diffraction) is being accomplished analytically. To this end, the diffraction effects in the film plane are to be computed for various geometries of the Gems printer. At first a spread function of Gaussian shape will be assumed and a knife edge image will be considered in place of the master transparency. Since the solution of this analytical case is numerically complex, it is being programmed on a computer. It is expected that the results of this analysis will be available during the next report period.

5.0 ACTIVITY FOR NEXT PERIOD

During the next period it is anticipated that the following items will be accomplished:

(a) Complete design modification of Gems making equipment.

(b) Analyze effect of Fresnel diffraction in Gems making technique.

(c) Procure split field microscope for Gems Viewer Study.

(d) Establish subcontract on psychophysical testing.

(e) Attend customer briefing and review psychophysical tests in light of briefing and subsequent discussions.

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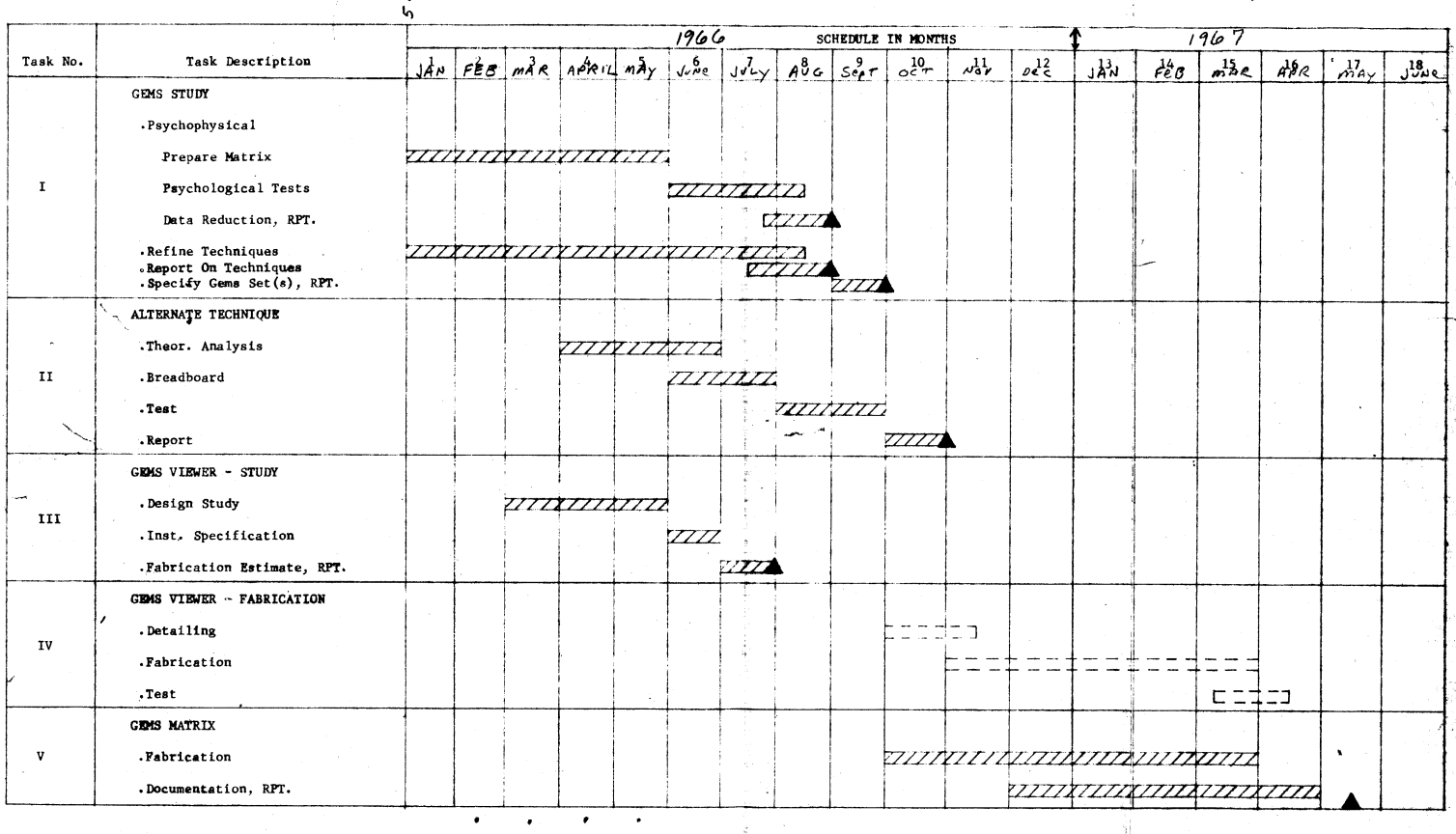

▲ Delivery of Report

Figure 1

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